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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/775,145	02/11/2004	Toshihiro Hayami	033082M194	2438
441	7590	05/03/2006	EXAMINER	
SMITH, GAMBRELL & RUSSELL, LLP 1850 M STREET, N.W., SUITE 800 WASHINGTON, DC 20036			ARANCIBIA, MAUREEN GRAMAGLIA	
			ART UNIT	PAPER NUMBER

1763

DATE MAILED: 05/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/775,145

Applicant(s)

HAYAMI ET AL.

Examiner

Maureen G. Arancibia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 February 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) 2 and 12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-11 and 13-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>04/04</u> . | 6) <input type="checkbox"/> Other: _____ |

Election/Restrictions

1. Applicant's election of Species B in the reply filed on 8 February 2006 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).
2. Applicant's argument that as currently recited, Claims 1, 4-11, and 14-18 are generic to Species A and B, and that Claims 3 and 13 are drawn to Species B, is persuasive. Accordingly, Claims 1, 3-11, and 13-18 will be examined on the merits.
3. Claims 2 and 12 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 8 February 2006.

Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: **32'** in Figure 1. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the

examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

5. Figure 5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claims 1, 3, 6-8, 11, 13, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art (AAPA) in view of U.S. Patent 5,643,364 to Zhao et al. (from Applicant's IDS).**

In regards to Claims 1 and 11, AAPA teaches a conventional plasma processing unit comprising: a processing container; first and second electrodes arranged in the processing container; a process gas supplying unit that supplies a process gas into the processing container (*process gas is introduced into a space between the pair of*

electrodes); a high-frequency electric power source that outputs high-frequency electric power having a frequency in the VHF band; a matching unit electrically connected to the high-frequency electric power source and the first electrode for impedance matching; and a transmission line that transmits the high-frequency electric power from the high-frequency electric power source to the matching unit; wherein a substrate to be processed is adapted to be arranged in the processing container, and the high-frequency electric power transmitted to the first electrode is adapted to generate plasma in such a manner that the substrate to be processed can undergo a plasma process by means of the plasma. (Instant Specification, Page 1, Line 15 - Page 2, Line 13)

While AAPA does not expressly teach that the inner pressure of the processing container can be reduced, the structure taught by AAPA would necessarily be structurally capable of performing this intended use. At least by supplying a lesser amount of gas, the inner pressure of the processing container could be reduced compared to the case of supplying a greater amount of gas. It has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959).

AAPA does not expressly teach that a transmission line having a length shorter than a length wherein a resonance state of a third harmonic wave of the high-frequency electric power may be generated transmits the high-frequency electric power from the source to the matching unit. Further in regards to Claims 3 and 13, AAPA also does not teach that the length of the transmission line is shorter than $3\lambda/4$, λ being a wavelength

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of the third harmonic wave of the high-frequency electric power, and with respect to the the third harmonic wave of the high-frequency power, an output terminal of the high-frequency electric power source is an electrically short-circuited end and an input terminal of the matching unit is an electrically open end.

Zhao et al. teaches a plasma processing unit (Figure 2), wherein a transmission line that transmits high-frequency power from high-frequency power generator 12 to processing container 10 is less than one eighth of the wavelength of the high-frequency power signal in length. (Column 3, Line 61 - Column 4, Line 6). Zhao et al. further teaches that when the transmission line is short compared to one quarter of the wavelength of the high-frequency power signal, the matching unit can be connected at either end of the transmission line; i.e. the transmission line in question can run from the high-frequency power generator to the matching unit, or from the matching unit, as part of the high-frequency power generator, to the processing container. (Column 2, Lines 40-44) An output terminal of the high-frequency power source 12 is an electrically short-circuited end and an input terminal of the matching unit 30 is an electrically open end. (Figure 2)

It would have been obvious to one of ordinary skill in the art to modify the apparatus taught by AAPA to have the length of the transmission line between the power source and the matching unit be less than one eighth of the wavelength of the high-frequency power signal, and to have an output terminal of the high-frequency power source be an electrically short-circuited end and an input terminal of the matching unit be an electrically open end. The motivation for having the length of the

transmission line be less than one eighth of the wavelength of the high-frequency power signal, as taught by Zhao et al. (Column 4, Lines 3-11), would have been to allow for the substitution of a relatively inexpensive, compact, reliable fixed matching unit for the conventional variable matching unit, which can be more expensive and less reliable. The motivation to have an output terminal of the high-frequency power source be an electrically short-circuited end and an input terminal of the matching unit be an electrically open end, as taught by Zhao et al. (Column 4, Line 63 - Column 5, Line 9), would have been to allow for the inclusion of comparator circuitry to adjust delivered power as measured at the electrically open end of the matching unit by comparison with a desired power 38, which is illustrated in Figure 2 to be set relative to ground (electrically short circuited end).

Setting the length of the transmission line to be less than one eighth of the wavelength of the high-frequency power signal translates to the length being less than $3\lambda/8$, λ being a wavelength of the third harmonic wave of the high-frequency electric power. (The frequency of the third harmonic is three times the frequency of the applied high-frequency power signal, and thus the wavelength of the third harmonic is also three times the wavelength of the applied power signal.) Having the length of the transmission line be less than $3\lambda/8$ meets the limitation that it be less than $3\lambda/4$ (a length where a resonance state of a third harmonic wave of the high-frequency electric power may be generated).

In regards to Claims 6 and 17, AAPA teaches that the transmission line is a coaxial cable. (Instant Specification, Page 2, Lines 4-5)

In regards to Claims 7 and 18, the range in frequency taught by AAPA of 30 MHz to 300 MHz (Instant Specification, Page 2, Lines 10-11) overlaps with the range recited in the claims of greater than 70 MHz, and thus meets the recited limitation.

In regards to Claim 8, AAPA teaches that the first and second electrodes are arranged parallel and opposed to one another. (Instant Specification, Page 1, Lines 19-20)

8. Claims 4, 5, and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Zhao et al. as applied to claims 1 and 11 above, and further in view of U.S. Patent 6,887,339 to Goodman et al. and U.S. Patent 6,703,080 to Reyzelman et al.

The teachings of AAPA and Zhao et al. were discussed above.

In regards to Claims 4, 14, and 16, the combination of AAPA and Zhao et al. does not expressly teach that the high-frequency power generating part generates high-frequency power when DC power is supplied to it, or that the DC power source converts commercial AC power to generate the DC power.

Goodman et al. teaches that a DC power source 114 converts commercial AC power (*line voltage power supply*) to DC power, and supplies the DC power to a high-frequency generating part (*converter 122*) via a cable. The high-frequency generating part then generates the high-frequency power. (Figure 7; Column 10, Lines 19-42)

It would have been obvious to one of ordinary skill in the art to modify the combination of AAPA and Zhao et al. to have the high-frequency power generating part generate high-frequency power when DC power is supplied to it, and to have a DC

power source that converts commercial AC power to generate the DC power. The motivation for making these modifications, as taught by Goodman et al. (Column 10, Lines 39-42), would have been that such an arrangement, among other benefits, allows the high-frequency power to be controlled by varying the voltage on the DC convertor.

In regards to Claims 4, 5, 14, and 15, the combination of AAPA, Zhao et al., and Goodman et al. does not expressly teach a filter, having an output terminal connected to the transmission line as an electrically short-circuited end, that selectively allows the high-frequency electric power from the high-frequency power generating part to pass through; or a circulator, connected between the high-frequency generating part and the filter, that allows a forward wave from the high-frequency power generating part to pass through and absorbs a reflected wave from the matching unit.

Reyzelman et al. teaches that a high-frequency power source 14 includes a filter (diplexer comprising low pass filter 52 and high pass filter 58) connected to the transmission line as an electrically short-circuited end (Figure 3B), that selectively allows the high-frequency electric power from the high-frequency power generating part to pass through; and a circulator 32, connected between the high-frequency generating part and the filter, that allows a forward wave from the high-frequency power generating part (power indicated at 28) to pass through and absorbs a reflected wave from the matching unit 60. (Figure 3B; Column 7, Lines 13-21; Column 9, Lines 3-30)

It would have been obvious to one of ordinary skill in the art to modify the combination of AAPA, Zhao et al., and Goodman et al. to include a filter and a circulator in the manner taught by Reyzelman et al. The motivation, as taught by Reyzelman et

al. (Column 9, Lines 31-34) for including a filter in the manner taught by Reyzelman et al., would have been to decrease the amplitude of reverse signals coming back from the plasma load through the matching unit and reaching the high-frequency power generating part. The motivation, as taught by Reyzelman et al. (Column 13, Line 55 Column 14, Line 3), would have been to provide isolation and suppression of reflected power caused by interactive plasma impedances that would otherwise degrade stability and reliability of the system.

9. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA in view of Zhao et al. as applied to claim 8 above, and further in view of U.S. Patent 5,210,466 to Collins et al.

The teachings of AAPA and Zhao et al. were discussed above. In regards to Claims 9 and 10, AAPA teaches that the power can be supplied to either electrode. (Instant Specification, Page 1, Lines 23-35) Therefore, either of the electrodes taught by AAPA may be considered to be the "first" electrode, while the other may be considered to be the "second" electrode.

The combination of AAPA and Zhao et al. does not expressly teach that a vent hole is provided in one of the electrodes to jet out the process gas towards the electrode holding the substrate to be processed.

Collins et al. teaches that vent holes 20 are provided in an electrode 27 to jet out the process gas towards the electrode 32c holding the substrate 15 to be processed. (Figure 1)

It would have been obvious to one of ordinary skill in the art to provide vent holes in one of the electrodes taught by the combination of AAPA and Zhao et al. to jet out the process gas towards the other electrode holding the substrate. The motivation for doing so, as taught by Collins et al. (Figure 1; Column 4, Line 64 - Column 5, Line 12), would have been to supply the process gas to the chamber for generation of the plasma above the substrate to be processed. One of ordinary skill in the art would further recognize that the vent holes taught by Collins et al. would allow the gas to be supplied uniformly across the diameter of the substrate to be processed, allowing for more uniform processing.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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